

LETTERS TO THE EDITORS

Attempts to copolymerize epichlorohydrin with 1,1-dimethyl ethylene oxide with triethyl aluminum as catalyst did not give a copolymer but a mixture of each homopolymer.

We are indebted to Dr. S. Nozakura for some helpful discussions, and to Mr. K. Katayama for x-ray examinations.

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A Light-Scattering Cell for Angular Measurements

The light-scattering method for determining the size and shape of macromolecules has become quite routine and finds widespread use. While the actual measurement can generally be accomplished easily and rapidly, preliminary operations, such as clarification, rinsing, transfers, and checking visually for dust, are often rather time-consuming and tedious. It is apparent that much of the difficulty could be avoided if the solution were to be clarified in the cell in which measurements are to be made.

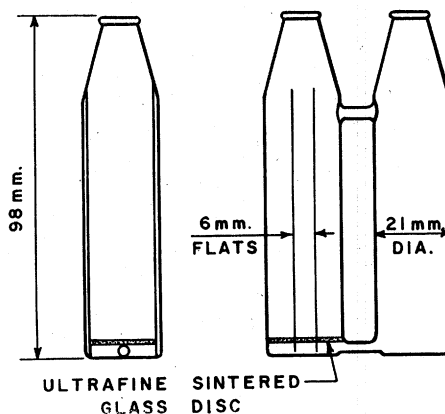


Fig. 1. Dimensions of light-scattering cell

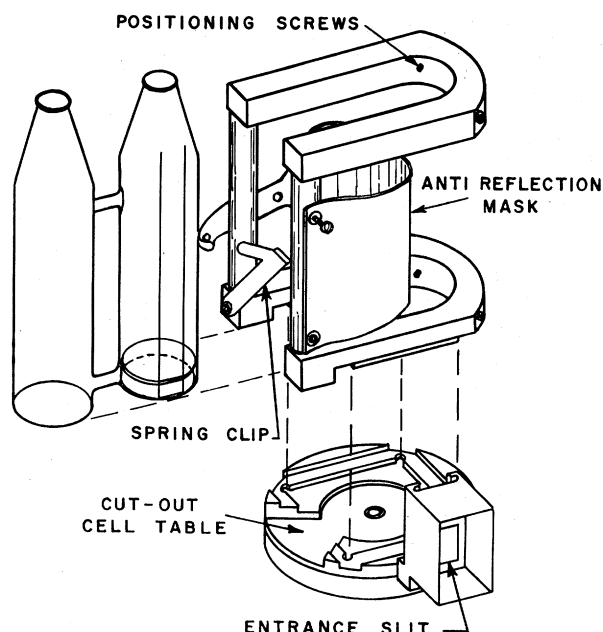


Fig. 2. Exploded view of cell, cell holder, and photometer table.

Schultz and co-workers¹ and Dandliker and Kraut² have employed the latter approach in their design of light-scattering cells that could be used directly in a centrifuge. The Schultz cell is limited in that it cannot be used with all solvents because of its partial metal construction. In addition, it appears to be relatively difficult to fabricate. Both the Schultz and Dandliker cells suffer from the disadvantage of requiring the use of a high-speed centrifuge.

The unit to be described in this communication combines the function of filter and light-scattering cell. As Figure 1 illustrates, it consists of a cylindrical cell into which has been fused an ultrafine sintered glass disc. The final cell resembles the Bier³ light-scattering filter. The 10-ml. cylindrical cell, of the Witnauer-Scherr type⁴ (obtained from Precision Glass Products, Philadelphia, Pa.*), is provided with flats for the entrance and exit of the incident beam, thereby preventing its refraction to angles at which scattered light can be observed. Both the solution reservoir and cell chambers are provided with tapered inlets to permit the application of low nitrogen pressure. In practice, solution is introduced into the reservoir and filtered *up* through the sintered disc into the cell. Approximately 8 to 10 ml. of solution is required for measurement.

The physical characteristics of the cell require a special holder to properly orient it in the Brice⁵ photometer. The holder shown in Figure 2 consists essentially of a frame with four positioning screws and a spring clip. The holder is placed on the cell table and the cell held against the positioning screws with the spring clip. Centering of the cell on the table and vertical alignment can be accomplished with a machinist's square and scale. It was found that alignment made for a single cell was quite satisfactory for eight others. Thus, the relatively lengthy alignment procedure need be carried out only once for a given set of cells. For actual measurements the cell is placed in the holder, secured with the spring clip, and the reservoir masked with the leather-velvet cover shown in Figure 2. Angular alignment is then carried out by rotation of the cell until the slit image is exactly

* The mention of specific commercial products does not constitute an endorsement by the United States Department of Agriculture.

reflected back to the slit. The rear of the photometer table was cut out to permit rotation of the cell.

Angular symmetry was verified with fluorescein solutions in the usual manner. Figure 3 shows a representative curve obtained with 1 mm. slit optics. It is apparent that the cell is symmetrical over the angular range 25 to 135°, thereby meeting the requirements of virtually all light-scattering studies. Also shown in Figure 3 is a curve for β -lactoglobulin ($c = 8.45 \times 10^{-3}$ g./ml., pH 4, $\Gamma/2 = 0.10$), a protein which is known to denature and aggregate relatively easily, but which, because of its small size, should exhibit a symmetrical scattering envelope. The curve for β -lactoglobulin is reasonably flat, showing significant deviation only at 25 degrees and below. It does not seem unreasonable to expect that with solvents such as benzene or toluene, which can usually be cleaned more effectively than water, angles below 25° might yield significant data.

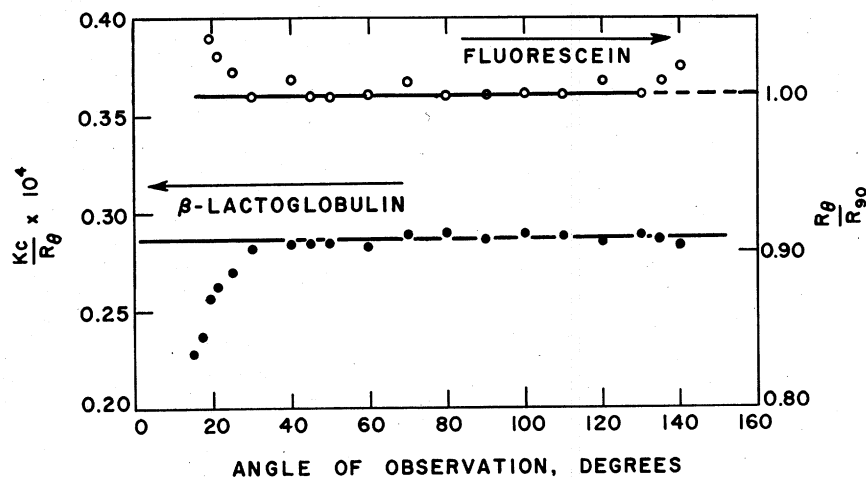


Fig. 3. Test of cell symmetry. Upper curve: Fluorescein in 0.100M KCl. Lower curve: β -Lactoglobulin, pH 4.0, 0.100M KCl, conc. = 8.45×10^{-3} g./ml.

An illustration of the utility of this type of cell is seen in a recent study of ascites tumor cell ribonucleic acid, the results of which will be presented elsewhere.⁶ The latter substance, being of very labile character, required very rapid angular measurements on a series of dilutions. By using nine cells and a multiplace pressure manifold, it was possible to clarify and measure the angular envelopes (17 individual angles) of nine separate solutions in 3½ hours, the last measurements being accomplished only 8 hours after completion of the nucleic acid preparation. Furthermore, it was possible to study the time dependence of the subsequent degradation-aggregation phenomenon since each separate solution could be maintained in clarified condition for an indefinite period.

We want to thank M. Seriani, Precision Glass Products, for his assistance in the design and fabrication of the cell and R. Calhoun for his efforts in solving the problem of cell mounting and alignment.

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